

Pacific Islands Regional Office (PIRO)
Bycatch Implementation Plan Status Report
June 2005

Minimizing Bycatch mortality

In April 2004, NOAA Fisheries promulgated regulations reopening the swordfish component of the Hawaii-based longline fishery. The new regulations included requirements for Hawaii longliners to carry on board “dehookers” to be used to release any hooked or entangled sea turtles. PIRO staff, trained in sea turtle dehooking techniques, conducted workshops for longline vessel operators and crew to enable them to effectively use dehookers to reduce the mortality on accidentally caught sea turtles. Fishermen and observers have successfully begun using the gear and have released 2 highly endangered leatherback turtles with the equipment. Additionally, PIRO has produced educational videos and placards in four languages on the use of dehooking equipment. These materials have been distributed to members of the longline fishing community.

PIRO staff and observers also have encouraged fishermen to use dehookers on sharks and billfish that are commonly killed and discarded in the fishery. On several deep-set longline trips, observers reported that fishermen were able to quickly and safely remove hooks from sharks using dehookers, releasing the sharks alive. The use of dehooking equipment on sharks and discarded billfish will increase the fleet’s proficiency with the new devices. This added proficiency will likely increase the number of successful releases of incidentally caught sea turtles. In 2005, PIRO received funding to assess the effectiveness of dehookers on large fish species. PIRO staff is in the process of hiring a contractor to complete the work. The PIRO observer program is recording instances of dehooker use on non-turtle species. This may allow analyses of observer data on the effectiveness of the devices in the future.

PIRO staff developed a side setting display that was shown at the Hawaii Protected Species Workshops. Flyers based on the display were also distributed. The technique is scheduled to become an option for fishermen to satisfy bycatch mitigation requirements. It has been shown to be highly effective in reducing seabird bycatch for pelagic longline fisheries. Several vessels have already converted to this operational style. Fishermen were also advised on currently required mitigation techniques. A side setting brochure, based on the display, has been produced and was distributed to fishermen in 2005. Additionally, a seabird identification guide was produced and distributed to fishermen and the members of the public.

The re-categorization of the Hawaii longline fishery to a Category I fishery under the MMPA prompted the reintroduction of a marine mammal section to the Hawaii Protected Species Workshops. PIRO staff gave presentations that included whale disentanglement techniques and produced and distributed deck placards on the techniques to fishermen. Fishermen were advised on reporting and permitting requirements under the MMPA. Several additional marine mammal related brochures and deck guides are currently being

produced and intended for distribution at the Hawaii Protected Species Workshops and around the Pacific region in 2005.

Assessment of mortality of discarded bottomfish

In 2004, PIRO initiated a collaborative project with the State of Hawaii's Division of Aquatic Resources on a Northwestern Hawaiian Islands carangid (jacks) tagging project. Fish tags, prepared by the State's Fish Tagging Project, are used in PIRO's NWHI bottomfish observer program to obtain information on post-capture survival rates of uluas, a bottomfish management unit species.

Research Accomplishments by the Pacific Islands Fisheries Science Center (PIFSC) in support of the Pacific Islands Region Bycatch Reduction Implementation Plan

Validation of self-reported discard data

The PIFSC continues to develop modeling techniques to investigate the number of catch and discards from Hawaii longline fishery logbooks by comparing logbook and observer records from the same sets. These models relate catches and discards reported by observers to operational data from logbooks and can be used to estimate catches and discards corrected for problems such as under-reporting and misidentification of species. This year an investigation of marlins, spearfish, and sailfish was completed that addressed the issue of whether regulatory changes to fishing operations and/or species misidentifications had biased the apparent trends in longline catch rates for these species. Although species misidentification was not uncommon, corrected trends showed the same general patterns as the nominal trends.

Minimization of shark bycatch and mortality in the Hawaii longline fishery

The resumption of the previously banned Hawaii swordfish fishery in late 2004 and 2005 will likely increase blue shark catches, as in the past blue sharks comprised about 50% of the total catch in this fishery. With the ban on finning, these sharks will not be retained and will be categorized as regulatory bycatch. During a longline research cruise scheduled for January-February 2005, researchers at PIFSC will conduct a pilot study to determine the potential use of an olfactory deterrent to reduce shark bycatch. This study will utilize recent discoveries by Dr. Eric Stroud, from Shark Defense LLC (New Jersey, USA), who has identified semiochemicals (chemical messengers important for shark orientation and survivorship) that have been shown to trigger a "flight reaction" in sharks, even while feeding (presented at the 2004 Joint Meeting of Ichthyologists and Herpetologists 26 - 31 May, 2004, in Norman, OK). One series of semiochemical repellents have shown favorable behavioral shifts in six species of sharks and can be administered by dosing a "cloud" of the repellent into a feeding school of sharks. Teleost fishes such as pilot fish and remora that accompany the sharks are not repelled, but continue to feed, suggesting that the repellent might reduce shark bycatch without affecting target species catch rates. Dr. Stroud's team is also developing a semi-solid repellent. This will be the first test of these shark repellent chemicals with longline fishing gear.

Pelagic shark stock assessment

Pelagic shark stock assessment work was initiated in the year 2000 as a collaborative effort with scientists at the National Research Institute for Far Seas Fisheries (NRIFSF). A report was produced (Kleiber, P., Y. Takeuchi, and H. Nakano. 2001. Calculation of plausible maximum sustainable yield (MSY) for blue sharks (*Prionace glauca*) in the North Pacific. Southwest Fisheries Science Center, Admin. Rep. H-01-02. 10p.) but was

not published in the peer reviewed literature. The report indicated that the stock was not being overfished. PIFSC and NRIFSF scientists are renewing the collaboration to update the blue shark assessment with input of the latest Japanese and Hawaiian longline fishery data, as well as input of better estimates of Taiwanese and Korean catch and effort data. They hope to use information from the foreign shark fin trade to improve the quality of the catch estimates that go into the assessment and to publish the results. In addition to updating the blue shark assessment, the hope is to conduct assessments on other shark species and to broaden the geographic scope to the whole of the Pacific.

Assessment of mortality of live discards

Although the fishery for spiny and slipper lobsters in the Northwestern Hawaiian Islands is presently closed, research to improve our stock assessment continues with an annual abundance survey and annual tag and release experiments. The latter provide opportunity to investigate the live-release of lobsters from fishing gear, with implications for the release of regulatory discards under possible future lobster fishery management scenarios. Using underwater cameras to watch lobsters exit from traps opened at depth in the presence of sharks and large predatory jacks, the PIFSC has found that no predation mortality occurs. The released lobsters take shelter in the surrounding habitat without being attacked by these predators.

The survivorship of pelagic fish released alive after being incidentally captured on commercial longline fishing gear is being examined using Pop-Up Satellite Archival Tags (PSATs). Using the resulting transmitted data from these PSATs, morbidity of released fish is being examined based on departure from normal horizontal and vertical movement patterns. Results from this study are also being used in collaboration with a researcher at Queen's University (Ontario), to try to quantify rates of morbidity and mortality in pelagic sharks and billfishes using a suite of biochemical assays to determine levels of stress from blood and/or tissue samples. This endeavor seeks to develop a cost-effective biochemical technique that could be used to sample large numbers of released pelagic fishes to quantify their chances for long-term survival. To date, researchers at the University of Hawaii, Joint Institute for Marine and Atmospheric Research (JIMAR), in collaboration with PIFSC and the NOAA CMER Program at Virginia Institute of Marine Science have deployed 143 PSATs on 30 swordfish; 40 marlin (37 blue, 1 black, and 2 striped); 10 tunas (5 bigeye and 5 yellowfin); and 63 sharks (8 bigeye thresher, 32 blue, 13 oceanic white-tip, 4 short fin mako & 6 silky sharks) in the central north Pacific Ocean. PSATs were programmed to release either 8 or 12 months following the deployments. Of the 128 PSATs scheduled to report as of September 2004, data were received from 72 devices, which is an overall reporting rate of 56 % (72 of 128). Conversely, 44 % of the tags are listed as "non-reporters." In aggregate, we have 496, 2216, 119, and 4270 days of observations from swordfish, marlins, tunas, and sharks, respectively, for a total of 7101 days (almost 20 yrs.). Among these species, the sharks are the most often discarded. Post-release survivorship of sharks from longline gear, however, appears excellent. Data retrieved from 29 tagged sharks clearly illustrates only one confirmed mortality of a blue shark.

PIFSC is conducting similar PSAT studies on sea turtles. A total of 23 PSATs were deployed on sea turtles in the Pacific Ocean in the Hawaii-based fishery (2), the California-based fishery (13), and in Costa Rica (8), and 3 more were deployed off Brazil. Data from only one of these turtles has indicated a depth profile indicative of mortality. In the Costa Rica study, the dive behavior and movements of longline caught turtles appears similar to those caught free-swimming with dip nets.

When a fish is caught, it experiences many different physiological challenges that can affect its long-term survival. The PIFSC collaboration with Queen's University seeks to categorize the release condition of fish biochemically and compare it to post-release behavior (from PSAT data) in the hope of observing correlations that could be used to predict survival from biochemical cues. Blood loss is assessed by measuring hematocrit, which reflects the level of blood cells in the circulation. Extreme exercise levels are assessed from lactic acid released into the blood. Strenuous exercise also results in muscle damage. Since many cells possess unique cellular markers, the presence of these molecules in the blood can be used as an index of tissue damage. When fish blood experiences hazardous conditions such as high temperature or oxidative stress, it can activate a line of defense that minimizes the damage to the blood cell. This "stress response" is recognized by stimulation of genes that lead to production of a suite of protective proteins called heat shock proteins. The PSAT and biochemical studies should help NMFS to understand the factors that cause delayed mortality of sharks and other large pelagics upon release, and to better quantify post-release mortality.

Assess bycatch of new fishing gear

PIFSC scientists estimated anticipated leatherback and loggerhead mortalities for the reopened Hawaii-based swordfish longline fishery based on the new gear and bait requirements, and using new guidelines developed by the NMFS Office of Protected Resources (OPR). The new OPR guidelines were developed following a workshop on post-hooking mortality held in Bethesda January 15-16, 2004, with participation by PIFSC staff. These innovations reduced the estimated mortalities by the modified swordfish fishing gear to 13% overall mortality rate for leatherbacks, and 17% for loggerheads, and brought the estimated totals for all species to levels below those previously found not to jeopardize the turtle populations (Epperly, S. P., and C. Boggs. 2004. Post-hooking mortality in pelagic longline fisheries using "J" hooks and circle hooks: application of new draft criteria to data from the northeast distant experiments in the Atlantic. Southeast Fishery Science Center, Protected Resources and Biodiversity Division. Internal document no. PRD-03/03-04. 8 pp.) The new OPR guidelines reduce the estimated mortality for turtles hooked externally, in the beak, or in the lower jaw, and increase mortality for hooks swallowed and for turtles released entangled or resuscitated. The new guidelines also reduce the estimated mortality when gear is removed from the turtle, and assign greater mortality rates to leatherbacks due to their relative fragility and lower anaerobic capacity.

Develop opportunities for NMFS/industry partnerships for bycatch reduction

The PIFSC is currently engaged in a number of industry-based experiments aimed at identifying means to reduce the incidental bycatch in longline fisheries around the Pacific and worldwide. Due to the high frequency of sea turtles in the Ecuadorian fishery, and the large artisanal fleet operating in this area, it has been identified as a prime location in which to develop and test potential mitigation methods. To date, the PIFSC, in collaboration with the Inter-American Tropical Tuna Commission, has successfully exchanged longline fishing gear (e.g., hook type, size) on 55 artisanal vessels operating out of Manta and other ports in Ecuador, and has already completed over 40 observed trips. In addition to the work in Ecuador, PIFSC has also begun collaborations with the fishing industry, scientists, NGOs, and government organizations in Guatemala, Colombia, Brazil, and Uruguay to conduct similar field trials as well as to expend our outreach and transfer of technology to reduce sea turtle bycatch in Latin American longline fisheries.

The PIFSC is attempting to increase communications on bycatch problems with several Pacific rim fishing nations. An invited presentation was made on "Cooperative research on by-catch reduction technology in the United States" at an International Fisheries Bycatch Symposium sponsored by the National Fisheries Research and Development Institute (NFRDI) of Korea in June, 2004. The presentation reviewed cooperative bycatch reduction gear development projects from all over the United States and amplified on the topic of longline interactions with seabirds and sea turtles.

A workshop sponsored by PIFSC to plan a joint Japan-Hawaii Sea Turtle and Seabird Experiment (JHSTSE) was convened in Honolulu September 14-16, 2004, with participation of scientists from the National Research Institute of Far Seas Fisheries (Japan) and NMFS, and with representatives from the Federation of Japan Tuna Fishery Cooperative Associations, the Japan Fishery Agency, Blue Oceans Institute, the Hawaii Longline Association, and the Western Pacific Regional Fishery Management Council. This group of scientists, industry representatives, NGOs, and managers met to discuss specific details of field experiments to be conducted in 2005 and beyond using research vessels, commercial longline vessels, and training vessels to test sea turtle and seabird bycatch reduction techniques. Both Japan and Hawaii have been involved in such studies for a number of years.

A PIFSC proposal to "Investigate Gear Modification to Reduce Marlin Bycatch in Deep-Set Longline Gear Targeting Tuna" was funded out of by the new "reducing bycatch" line in the FY 04 budget. The budget provided \$201K for the project, in which contracted tuna longline vessels will test fishing with the shallowest hooks moved deeper to avoid catching marlin. Logbooks indicate about 2-3% of istiophorid billfishes (marlins and spearfish) are discarded. The incidental retained catch of these fish comprise 6% of the marketed total catch. A perennial issue for PIR fishery managers has been the request by recreational fishermen and conservationists to ban longline retention of these fish, which would cause this 6% of the total catch to become bycatch (discarded). PIFSC staff also contributed to a publication on this means of reducing marlin bycatch (Kitchell, J.F., I.C. Kaplan, S.P. Cox, S.J Martell, T.E. Essington, C.H. Boggs and C.J. Walters. 2004. Ecological and economic components of alternative fishing methods to reduce by-catch of marlin in a tropical pelagic ecosystem. *Bulletin of Marine Science* 74(3): 607-619).